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THE ECONOMY OF NORTHWESTERN COLORADO

DESCRIPTION AND ANALYSIS

EXECUTIVE SUMMARY

SUBMITTED TO BUREAU OF LAND MANAGEMENT

CONTRACT #52500-CT5-1019

by S. L. Gray
J. R. McKean
J. C. Weber

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EXECUTIVE SUMMARY

The purpose of this report is to provide an economic description and analysis of the northwest part of Colorado. The intent of the researchers is to provide detailed information contributing to the decision-making and planning processes and to provide a planning tool having the capability of analyzing a number of alternative development scenarios in the study region.

The study region consists of Delta, Eagle, Garfield, Mesa, Moffat, Montrose, Pitkin, Rio Blanco, and Routt Counties plus the Somerset coal area of Gunnison County. The economic base for the local economy is primarily due to minerals extraction and recreation oriented industry. The region also contains an expanding "light" industries sector which produces for export. Future rapid expansion of the economic base is expected in the coal and electricity sectors and possibly in the oil shale sector. These growth sectors are expected to experience greatly increased demands which will lead to an expansion of non-basic sectors as well. It is to this particular scenario of development that this report is directed.

Decisions concerning the future of this region lie, to a great extent, outside the direct control of the current inhabitants. Ownership of large deposits of exploitable resources is vested largely with the Federal government and corporations headquartered outside the region. Water use, which is of particular importance both to the development of energy resources and also to the existing economic structure in this semi-arid environment, provides an example of possible forthcoming economic conflict. Future regional growth could result in trade-offs which have harsh economic consequences for some

existing producing sectors. From this perspective there is a need to develop a detailed analytical framework which is capable of assessing the direct and indirect consequences of alternative scenarios for resource exploitation proposed or allowed (condoned) by public and private sectors of the economy.

The comprehensive inter-industry production model which is incorporated in this study (often termed the input-output model) is the economic tool best suited to provide both a detailed description of the economy as it presently exists (in 1974) and an analytical framework which is capable of assessing the direct and indirect consequences of alternative scenarios of resource exploitation (or other future developments).

As is well known, the input-output model is constructed through the collection of extensive primary data which show flows of sales and purchases among intermediate economic sectors or industries in the regional economy and sales to final demand (sales for final use in the region or sales to exports). It is the final demand sales which are assumed to drive the local economy. Basic industry such as coal or other energy extraction may expand due to economic forces outside the region. This expansion of basic industry supports an expansion of non-basic service and supply industries within the region. These export-linked industries require inputs from other local industries and the chain of interdependencies leads to a cumulative expansion of economic activity within the region. Since a well conceived input-output model also delineates social overhead services sectors the technique is capable of assessing not only the positive expansionary impacts on incomes and employment by sector but also may be used to estimate the future requirements for local tax supported production. The development of water use coefficients allows the extension of the input-output technique to the analysis of water use in the regional economy.

The descriptive component of the study is accommodated through the collection of extensive detailed primary data, from firms and local government within the region, and subsequent tabulation of the data according to the inter-industry flows framework. The analytical phase consists of the impact analysis, development of various multipliers, and consistent forecasting under alternative resource development scenarios.

It might be noted that, as opposed to the typical economic partial equilibrium model, the input-output technique provides a method of economic projection which takes account of and adjusts for the interdependencies among producing sectors. Hence the projected production by sector includes the viewpoint of the economy as a whole and each sector's projected production is just what is needed by that sector and throughout the regional economy to support the projected outputs in each of the other sectors. An accounting balance among inputs and outputs is maintained at all times for the region.

The usefulness of the input-output technique is predicated upon a proper delineation of economic sectors, as determined by the purposes for the construction of the model. Non-basic or intermediate processors must be subdivided into meaningful homogeneous categories in view of the economic structure of private industry in the region and also for the purpose of measuring the relationships among private industry and local government services. Final demands must be subdivided into groupings for which consistent independent activities are known to exist. Sector definitions may be limited by the high costs of time and finances required for detailed separation of the data into industry flows and more importantly by lack of data or disclosure laws which prevent publication of data which could reveal business information concerning individual private firms. The detail of the sectoring for the Northwest Colorado study is revealed in the row and column headings in Table 1. Special features of the sectoring plan include the separation of underground coal mining from surface mining, the delineation of six agricultural sectors with special emphasis on division by intensity of water use, special sectors to show the demand for local governmental services as well as a detailed final demands component providing much information about various categories of government activity in the region. The model is of unique design which allows replacement of final demand sectors into the processing portion of the table if an analysis of certain sectors such as oil shale spending or spending for education and social services is to be considered as endogenous in future studies.

Previous experience with questionnaires employed to obtain primary information for interindustry studies suggested that, where possible, all interviews should be conducted in accounting language tailored to the individual firms involved. A questionnaire was designed as an interview focal point and as an item that could be left with an interviewed firm for mail return when necessary. Personal interview with the entrepreneur or manager provided translation from the firm's accounts to the Standard Industrial Classification basis utilized on the questionnaire. A large majority of the primary data were collected as field notes by the survey team and later transcribed into the appropriate accounts for the input-output model. This approach ensured accuracy in the allocation of purchases and sales into the appropriate sectors. Collecting data on both outlays and sales for each firm provided a double entry accounting balance as a cross check on the primary data. In addition to the outlay and sales data, information was solicited on the nature of the firm's product lines, number of employees, water use and level of utilization of productive capacity.

The descriptive analysis of the Northwestern Colorado Region is summarized in the transactions table, the table of direct production requirements and the table of direct plus indirect production requirements. These tables, which are derived from the basic flows data collected from primary survey and secondary sources, also provide the basis for the calculation of the various business activity and income multipliers and the analysis of employment and water use in the region. It should be noted that the livestock sector, in 1974, suffered severe financial losses and as a result was not representative of normal sector activity. Consequently, to avoid distorting the analysis the livestock sector has been normalized prior to the construction of the transactions table. Because of space limitations, the tables of direct production requirements and direct plus indirect production requirements are not shown.

The Transactions Table

The first essential component of any interindustry study is the collection and tabulation of data which serve to describe the flows of commodities from each supplying sector to each purchasing sector. These flows are typically expressed in terms of the dollar value of transactions occurring in a specific period of time, normally one year. The information is arrayed in tabular form with the suppliers (selling sectors) listed at the left of the table and the purchasing sectors listed at the top. The information in this table, termed the transactions table, does two things simultaneously: it identifies the estimated dollar value of sales by each sector to each of the other sectors, (thus, the distribution of each sector's output) and it identifies the purchases of ingredients of production by each sector from each of the other sectors (the distribution of purchases). In essence, the material contained in the transactions table represents a double-entry system of bookkeeping in which every sale is simultaneously described as a purchase. Thus, the system deliberately double counts.

The distribution of total output of each sector, according to the sectors in which the output is sold, may be readily discerned by reading across the rows of Table 1. The bill of purchases by each sector is found by reading down any column of the table. These column entries show the allocation of purchases by cost component.

For example, consider sector 2, irrigated agriculture. Reading across row 2 of Table 1 shows that the total output of irrigated agriculture was distributed in the following way: $9,717 worth of output was sold to dryland agriculture; $2,270,025 to dairy agriculture; $6,852,437 to livestock, $42,537 to agricultural services; and $4,389,517 to food and kindred products Total sales by irrigated agriculture to the processing sector of the economy thus amounted to $13,564,233. The remaining sales were to the final demand sectors consisting of households, $201,913; net inventory accumulation, $2,708,952; exports to Colorado, $3,375,468; and exports to the rest of the world, $6,514,141. Total sales to final demand thus amounted to $12,800,474. The total gross output of the irrigated agriculture sector is the sum of these individual sales or $26,364,707.

The distribution of purchases by irrigated agriculture, by cost category, are shown in column 2 of Table 1. Purchases by irrigated agriculture from livestock were estimated at $213,337; from the agricultural services sector, $1,268,896; from repair and maintenance construction, $55,000; from printing and publishing, $3,522; from fabricated metals, $38,314; from other manufacturers, $157,614; from transportation, $154,674; from U. S. Postal Service, $7,547; from communication, $60,126; from electricity and natural gas utilities, $255,318; from water, sewer, and trash removal services, $716,738; from gasoline and automobile dealers, $1,644,542; from other trade, $27,314; from finance, $1,732,762; from insurance and real estate, $403,744; from services.

TABLE 1

NORTHWESTERN COLORADO GROSS FLOWS TABLE
LIVESTOCK SECTOR NORMALIZED, 1974 DOLLARS

		1 FRUIT AG	2 IRRIG AG	3 DRYLAND AG	4 DAIRY AG	5 LIVESTOCK	6 AG SER,FOR	7 METAL MIN	8 COAL UNDER	9 COAL STRIP	10 PET-NAT GS
1	FRUIT AG	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
2	IRRIG AG	-0.	-0.	9717.	2270025.	6852437.	42537.	-0.	-0.	-0.	-0.
3	DRYLAND AG	-0.	-0.	-0.	-0.	782185.	-0.	-0.	-0.	-0.	-0.
4	DAIRY AG	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
5	LIVESTOCK	-0.	213337.	48900.	-0.	16174303.	-0.	-0.	-0.	-0.	-0.
6	AG SER,FOR	2705844.	1268896.	318378.	102184.	1528667.	-0.	-0.	-0.	-0.	-0.
7	METAL MIN	-0.	-0.	-0.	-0.	-0.	-0.	4873014.	-0.	-0.	-0.
8	COAL UNDER	-0.	-0.	-0.	-0.	-0.	-0.	15151.	3697440.	-0.	-0.
9	COAL STRIP	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	1973637.	-0.
10	PET-NAT GS	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	14734548.
11	NONMET MIN	-0.	-0.	-0.	-0.	-0.	-0.	48489.	143868.	-0.	7617.
12	CONSTRUCTN	-0.	55000.	53596.	-0.	480976.	-0.	20000.	267960.	251079.	1054491.
13	FOOD PROC	-0.	-0.	-0.	5109.	1646288.	-0.	-0.	-0.	-0.	-0.
14	WOOD PROD	-0.	-0.	-0.	-0.	-0.	-0.	1418580.	154077.	-0.	132295.
15	PRINT-PUB	-0.	3522.	-0.	-0.	4651.	4515.	1093.	-0.	1026.	149593.
16	CONCRETE	-0.	-0.	-0.	-0.	-0.	-0.	1566.	19361.	-0.	-0.
17	FAB METALS	-0.	38314.	7253.	-0.	64544.	-0.	349305.	212185.	258752.	611322.
18	ELECTRONIC	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
19	MFG NEC	19734.	157614.	100134.	11151.	482362.	33461.	36992.	16712.	23775.	167452.
20	TRANSPORT	828320.	154674.	336.	-0.	154599.	16678.	2304665.	4820110.	503421.	2948121.
21	POSTAL SER	253.	7547.	500.	400.	13500.	3201.	3733.	2134.	3010.	7771.
22	COMMUNICAT	2703.	60126.	54011.	1590.	163570.	30878.	59078.	52475.	15469.	112798.
23	ELEC-GS UT	58040.	255318.	81016.	67952.	880900.	84935.	949210.	477175.	582512.	4938231.
24	WATER-SAN	89260.	716738.	-0.	1060.	688942.	5197.	12575.	29595.	11232.	50777.
25	WHOLESALE	110560.	1644542.	394803.	19726.	3520412.	192542.	70900.	144151.	106481.	2511408.
26	GS-AUT DLR	-0.	140374.	36058.	1675.	161501.	32487.	9005.	23083.	16226.	162578.
27	EAT-DR-LOD	-0.	-0.	-0.	-0.	-0.	4446.	-0.	-0.	9289.	46293.
28	TRADE NEC	-0.	27314.	39073.	1384.	263631.	4889.	17393.	9564.	1390.	351867.
29	FINANCE	719717.	1732762.	1438592.	233491.	7373782.	58776.	15430.	-0.	-0.	1259518.
30	INS-R EST	141846.	403744.	339547.	2382.	1092524.	43066.	491366.	900378.	173224.	384524.
31	MEDICAL	-0.	-0.	-0.	-0.	-0.	-0.	42229.	34334.	10919.	-0.
32	SERVIC NEC	196152.	686064.	450101.	318526.	2005892.	178854.	78892.	83984.	73278.	2007592.
33	SUBTOTAL	4872429.	7565886.	3372015.	3036655.	44335666.	736462.	10818666.	11088586.	4014720.	31638796.
34	HOUSEHOLDS	1288497.	1687441.	303709.	233491.	5770988.	1366176.	9506068.	11591928.	3439380.	6582115.
35	EDUCATION	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	2034.	-0.
36	SOCIAL SER	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
37	LOCAL ROAD	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
38	LOC GV NEC	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
39	LOC GV TAX	356625.	892498.	589299.	131744.	3069515.	20762.	390698.	267463.	217090.	3772651.
40	STATE GV	17448.	154540.	36768.	9244.	664965.	44782.	148797.	209447.	206144.	5832776.
41	FEDERAL GV	91746.	72342.	18223.	14009.	566633.	391570.	2555234.	3540251.	2039472.	41600129.
42	PROFITS	930444.	10320212.	1499884.	1213034.	12906962.	800710.	5337018.	2667147.	1417552.	66954359.
43	DEPREC	235611.	1821805.	1907829.	374506.	4869137.	303626.	3002424.	2556281.	1283731.	6074743.
44	TRANSFERS	36380.	145512.	124852.	2217.	352403.	37768.	457297.	569225.	157501.	122578.
45	IMP-COLO	43410.	721163.	184017.	61744.	1647233.	3649801.	3902951.	1760170.	5161089.	25214015.
46	IMP-WORLD	474337.	2983308.	749693.	32572.	6739708.	591553.	5309111.	8131376.	3922827.	11885579.
47	TOTAL	8346927.	26364707.	8786289.	5109216.	80923210.	7943210.	41428264.	42381874.	21861540.	199677741.

TABLE 1 (continued)

		11 NONMET MIN	12 CONSTRUCTN	13 FOOD PROC	14 WOOD PROD	15 PRINT-PUB	16 CONCRETE	17 FAB METALS	18 ELECTRONIC	19 MFG NEC	20 TRANSPORT
1	FRUIT AG	-0.	-0.	289505.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
2	IRRIG AG	-0.	-0.	4389517.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
3	DRYLAND AG	-0.	2231.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
4	DAIRY AG	-0.	-0.	4964000.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
5	LIVESTOCK	-0.	-0.	2381720.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
6	AG SER,FOR	-0.	-0.	5873.	1673605.	-0.	-0.	-0.	-0.	-0.	-0.
7	METAL MIN	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
8	COAL UNDER	-0.	-0.	4116.	-0.	-0.	-0.	-0.	-0.	1488.	-0.
9	COAL STRIP	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
10	PET-NAT GS	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
11	NONMET MIN	-0.	4246852.	87000.	-0.	-0.	451654.	-0.	-0.	940.	-0.
12	CONSTRUCTN	66748.	65332711.	114600.	587746.	39098.	67321.	302797.	85184.	-0.	27000.
13	FOOD PROC	-0.	-0.	1048358.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
14	WOOD PROD	1335.	991168.	1432.	156054.	-0.	2786.	4037.	-0.	-0.	2000.
15	PRINT-PUB	2069.	79578.	9061.	2833.	1906.	10057.	3755.	1067.	2223.	29898.
16	CONCRETE	-0.	8168461.	-0.	-0.	-0.	16184.	-0.	-0.	-0.	49979.
17	FAB METALS	56250.	581418.	33234.	6654.	-0.	-0.	-0.	-0.	316882.	2000.
18	ELECTRONIC	66748.	-0.	-0.	155254.	-0.	-0.	-0.	-0.	-0.	1000.
19	MFG NEC	2510.	515112.	38729.	1118.	34530.	106123.	2095.	17278.	29138.	228550.
20	TRANSPORT	2670.	1793028.	537919.	272073.	68918.	184317.	307171.	107582.	615444.	663064.
21	POSTAL SER	4672.	9891.	5720.	2107.	43296.	4434.	4576.	296070.	2902.	14162.
22	COMMUNICAT	20024.	495076.	142796.	18231.	79704.	74471.	20994.	109365.	40979.	195122.
23	ELEC-GS UT	100122.	176889.	560940.	294931.	47126.	82007.	70464.	129704.	551681.	43667.
24	WATER-SAN	1001.	19524.	93481.	2661.	3401.	9151.	3687.	10692.	1717.	1617.
25	WHOLESALE	32934.	946465.	206851.	107545.	11434.	86158.	17238.	8908.	247663.	79085.
26	GS-AUT DLR	-0.	500118.	37602.	1086.	33525.	103034.	2034.	16775.	7901.	218985.
27	EAT-DR-LOD	13731.	365097.	29012.	385.	6885.	6368.	-0.	-0.	239.	17143.
28	TRADE NEC	6274.	4026378.	69361.	1459.	15315.	154153.	272.	156354.	20895.	284879.
29	FINANCE	533985.	297429.	307627.	240701.	259654.	211259.	98483.	37343.	98108.	34786.
30	INS-R EST	705912.	1575590.	76795.	47387.	29884.	76417.	59949.	178595.	131295.	448010.
31	MEDICAL	-0.	148746.	4111.	355.	-0.	-0.	-0.	-0.	1938.	3000.
32	SERVIC NEC	100417.	1912209.	210273.	445433.	554529.	141597.	125187.	313293.	128942.	1505764.
33	SUBTOTAL	1717002.	92093750.	15609633.	4017618.	1229205.	1787491.	1022739.	1468210.	2200376.	3849711.
34	HOUSEHOLDS	392936.	43775708.	5985826.	2861612.	2130399.	2448699.	2253155.	7998321.	2890892.	16629633.
35	EDUCATION	-0.	-0.	3971.	2129.	-0.	-0.	8075.	16004.	-0.	1000.
36	SOCIAL SER	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
37	LOCAL ROAD	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
38	LOC GV NEC	-0.	148746.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	24563.
39	LOC GV TAX	10012.	501295.	330721.	65322.	53975.	114052.	11767.	80881.	455356.	1196192.
40	STATE GV	78096.	280839.	138432.	59513.	83152.	131918.	19528.	114098.	72874.	2252544.
41	FEDERAL GV	630200.	3959113.	1540962.	798656.	183517.	740738.	171253.	1452159.	793049.	2530182.
42	PROFITS	2517391.	10130383.	1743746.	701861.	521329.	1430059.	625526.	1386624.	1346847.	5164628.
43	DEPREC	367113.	2662594.	1003560.	699541.	647329.	527396.	173673.	526995.	1028042.	2977096.
44	TRANSFERS	35393.	1466344.	70750.	44107.	27812.	71119.	37006.	160607.	115347.	350870.
45	IMP-COLO	31923.	24546015.	3585321.	2067372.	251759.	4182794.	526853.	1392928.	1342175.	196[illegible]2022.
46	IMP-WORLD	66206.	28237325.	5366966.	2093890.	1008696.	1471607.	1948456.	7662012.	14140740.	4202237.
47	TOTAL	5845472.	208002112.	35379688.	13412621.	6137173.	12905873.	6798[illegible]6.	22256639.	24385698.	55910678.

TABLE 1 (continued)

		21 POSTAL SER	22 COMMUNICAT	23 ELEC-GS UT	24 WATER-SAN	25 WHOLESALE	26 GS-AUT DLR	27 EAT-DR-LOD	28 TRADE NEC	29 FINANCE	30 INS-R EST
1	FRUIT AG	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
2	IRRIG AG	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
3	DRYLAND AG	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
4	DAIRY AG	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
5	LIVESTOCK	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
6	AG SER,FOR	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
7	METAL MIN	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
8	COAL UNDER	-0.	-0.	750005.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
9	COAL STRIP	-0.	-0.	3951619.	-0.	-0.	-0.	-0.	65973.	-0.	-0.
10	PET-NAT GS	-0.	-0.	9884441.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
11	NONMET MIN	-0.	-0.	-0.	1322.	-0.	-0.	-0.	-0.	-0.	-0.
12	CONSTRUCTN	13000.	18236.	41400.	96848.	454588.	111986.	1220797.	497450.	44107.	2515769.
13	FOOD PROC	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
14	WOOD PROD	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
15	PRINT-PUB	-0.	64506.	37334.	7171.	72600.	356476.	147675.	1552688.	385850.	687493.
16	CONCRETE	-0.	-0.	4661.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
17	FAB METALS	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
18	ELECTRONIC	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
19	MFG NEC	36713.	72453.	70566.	22606.	382012.	125515.	8593.	258197.	8466.	178135.
20	TRANSPORT	32500.	5836.	134686.	1236.	4166600.	2700600.	311400.	6130351.	35830.	94017.
21	POSTAL SER	-0.	37813.	47217.	14052.	69175.	48728.	55115.	230954.	234481.	74971.
22	COMMUNICAT	25620.	124123.	337967.	29193.	589090.	512245.	2129348.	3234075.	524354.	803867.
23	ELEC-GS UT	43380.	107950.	12401001.	216392.	350914.	328564.	1813537.	1507790.	257748.	345868.
24	WATER-SAN	2500.	7004.	9920.	388445.	16885.	69120.	211680.	192533.	16857.	44890.
25	WHOLESALE	10774.	22436.	78933.	181438.	170734.	303650.	1556314.	356387.	10216.	404633.
26	GS-AUT DLR	35645.	70344.	71218.	21948.	273621.	91773.	8343.	325179.	8220.	172950.
27	EAT-DR-LOD	-0.	6404.	33735.	3580.	115232.	10667.	-0.	35766.	28988.	545089.
28	TRADE NEC	1069.	14561.	20409.	75064.	42727.	31825.	541556.	103543.	35855.	174857.
29	FINANCE	-0.	2635817.	1462381.	2549468.	1476683.	854407.	4280176.	1735437.	67021.	576097.
30	INS-R EST	-0.	96657.	256412.	100203.	276357.	485268.	977262.	3164624.	199162.	2136988.
31	MEDICAL	-0.	-0.	1144.	-0.	45458.	-0.	-0.	-0.	-0.	-0.
32	SERVIC NEC	78000.	212753.	439480.	668628.	1147853.	1045218.	2204774.	3411997.	2597808.	3328286.
33	SUBTOTAL	279201.	3496893.	30034529.	4377594.	9650729.	7076042.	15466570.	22802944.	4454963.	12083910.
34	HOUSEHOLDS	5449501.	9124365.	12741514.	2916711.	10930031.	13171596.	21043650.	34520906.	8895564.	9415585.
35	EDUCATION	-0.	-0.	-0.	1406.	8391.	-0.	-0.	-0.	-0.	-0.
36	SOCIAL SER	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
37	LOCAL ROAD	-0.	-0.	-0.	40002.	-0.	-0.	-0.	-0.	-0.	-0.
38	LOC GV NEC	-0.	179638.	780911.	586425.	-0.	-0.	28017.	-0.	-0.	-0.
39	LOC GV TAX	-0.	1528470.	2069078.	-0.	823527.	796428.	1280218.	5543523.	184877.	720226.
40	STATE GV	-0.	303562.	243975.	1275.	505772.	128586.	185103.	554612.	377812.	89194.
41	FEDERAL GV	491499.	1976296.	6503453.	323109.	4790149.	1796259.	2694592.	5817368.	4076114.	1400761.
42	PROFITS	224250.	3303643.	2116915.	640460.	15330645.	5807015.	14968050.	31461663.	9921852.	4595455.
43	DEPREC	91000.	3681009.	3774362.	1301693.	1636975.	1025076.	4145778.	3900013.	446253.	1210437.
44	TRANSFERS	-0.	1273875.	238494.	90501.	257196.	451622.	909502.	1668591.	32100104.	23318318.
45	IMP-COLO	399807.	2184560.	1349210.	453815.	873307.	617497.	3107943.	1996204.	3831561.	3102202.
46	IMP-WORLD	149742.	208105.	1990156.	606008.	5112787.	1357077.	5932935.	3080794.	3881480.	2716828.
47	TOTAL	7085000.	27260416.	61842597.	11338999.	49919509.	32227198.	69762358.	111346618.	68170580.	58652916.

TABLE 1 (continued)

		31 MEDICAL	32 SERVIC NEC	33 SUBTOTAL	34 HOUSEHOLDS	35 EDUCATION	36 SOCIAL SER	37 LOCAL ROAD	38 LOC GV NEC	39 LOC GV TAX	40 STATE GV
1	CULT AG	-0.	-0.	289505.	327812.	-0.	-0.	-0.	-0.	-0.	-0.
2	IRRIG AG	-0.	-0.	13564233.	201913.	-0.	-0.	-0.	-0.	-0.	-0.
3	DRYLAND AG	-0.	-0.	784416.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
4	DAIRY AG	-0.	-0.	4964000.	145216.	-0.	-0.	-0.	-0.	-0.	-0.
5	LIVESTOCK	7653.	-0.	18825913.	-0.	-0.	-0.	-0.	-0.	-0.	10326.
6	AG SER,FOR	-0.	-0.	7603447.	237150.	-0.	-0.	-0.	1444.	-0.	3446.
7	METAL MIN	-0.	-0.	4873014.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
8	COAL UNDER	-0.	-0.	4468200.	833217.	16536.	-0.	-0.	-0.	-0.	-0.
9	COAL STRIP	-0.	-0.	5991229.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
10	PET-NAT GS	-0.	-0.	24618989.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
11	NONMET MIN	-0.	-0.	4987742.	419736.	-0.	-0.	209762.	2078.	-0.	205421.
12	CONSTRUCTN	180771.	284500.	74285759.	3977808.	20068.	-0.	236258.	120294.	-0.	14406528.
13	FOOD PROC	122375.	-0.	2822130.	7610682.	394640.	-0.	-0.	17196.	-0.	16740.
14	WOOD PROD	-0.	-0.	2863764.	83489.	-0.	-0.	-0.	-0.	-0.	8818.
15	PRINT-PUB	205201.	389050.	4212891.	851783.	16152.	3432.	6025.	95662.	-0.	11025.
16	CONCRETE	-0.	-0.	8260212.	574099.	-0.	-0.	14339.	8206.	-0.	457951.
17	FAB METALS	-0.	141842.	2679955.	-0.	-0.	-0.	82297.	15223.	-0.	3318.
18	ELECTRONIC	-0.	-0.	223002.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
19	MFG NEC	78342.	91566.	3357734.	4131215.	64860.	6238.	39869.	59547.	-0.	115693.
20	TRANSPORT	70072.	735192.	30701430.	4746786.	87588.	5366.	4057.	20036.	-0.	95388.
21	POSTAL SER	300780.	122251.	1665416.	2746009.	58794.	12203.	1438.	104226.	-0.	17940.
22	COMMUNICAT	415189.	733503.	11208034.	14182247.	204409.	13696.	17399.	168395.	-0.	66733.
23	ELEC-GS UT	308617.	1314522.	29429103.	12898256.	961369.	10783.	333645.	186488.	-0.	170203.
24	WATER-SAN	78035.	146701.	2896878.	5174184.	174282.	357.	10139.	147197.	2526659.	3374.
25	WHOLESALE	294668.	1448829.	15298818.	11224322.	277341.	2096.	652303.	79284.	-0.	254543.
26	GS-AUT DLR	76062.	88901.	2748251.	18595943.	62972.	6057.	30709.	52456.	-0.	112325.
27	EAT-DR-LOD	698.	125490.	1404537.	21593415.	14077.	-0.	1239.	3502.	-0.	7095.
28	TRADE NEC	241343.	983285.	7717939.	87218269.	144343.	6802.	15826.	101423.	-0.	158897.
29	FINANCE	455388.	1130035.	32174553.	26267646.	1764070.	-0.	202744.	511200.	-0.	-0.
30	INS-R EST	889455.	1067594.	16952018.	21878275.	704139.	14297.	100735.	240032.	-0.	191988.
31	MEDICAL	2238331.	-0.	2440344.	33255600.	23503.	42690.	-0.	212067.	842858.	12343394.
32	SERVIC NEC	1181314.	4142628.	31975718.	24128814.	390969.	17368.	98499.	699358.	-0.	1356111.
33	SUBTOTAL	7144294.	12945889.	376289174.	303303886.	5380172.	141385.	2057283.	2845314.	3369517.	29717257.
34	HOUSEHOLDS	23079591.	26783456.	309209044.	3220000.	34835063.	757621.	5327780.	9695560.	-0.	11046491.
35	EDUCATION	-0.	24218.	67228.	3001954.	167530.	-0.	242.	4136.	21883362.	24957135.
36	SOCIAL SER	-0.	-0.	0.	-0.	18563.	928.	-0.	6886.	1236059.	6334849.
37	LOCAL ROAD	-0.	-0.	40002.	141549.	-0.	-0.	182693.	-0.	4650515.	6647116.
38	LOC GV NEC	-0.	-0.	1748300.	1093822.	54233.	40753.	245635.	504516.	14840566.	1286653.
39	LOC GV TAX	580216.	1991459.	28045940.	16747866.	-0.	-0.	-0.	-0.	-0.	-0.
40	STATE GV	446663.	302848.	13695307.	40125491.	3816765.	-0.	40.	262260.	-0.	1184151.
41	FEDERAL GV	1360814.	3738007.	98717859.	85427763.	12980.	43722.	309511.	411288.	-0.	298385.
42	PROFITS	24772216.	14502484.	251260364.	26539884.	4550689.	297163.	2433987.	6879055.	3673151.	1348402.
43	DEPREC	1200554.	4177576.	59834358.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
44	TRANSFERS	827783.	810623.	66331697.	20497708.	655316.	6315732.	93750.	221996.	-0.	[illegible]
45	IMP-COLO	2954037.	6342153.	127156656.	65766917.	1937822.	6983.	641259.	737942.	-0.	[illegible]
46	IMP-WORLD	3003921.	24447199.	159505231.	162271604.	2896344.	18559.	1425341.	1271102.	-0.	[illegible]
47	TOTAL	65370089.	96065912.	1491901160.	728138444.	54325477.	7622843.	[illegible]	22840055.	49653170.	[illegible]

TABLE 1 (continued)

		41 FEDERAL GV	42 SHALE R+D	43 INVESTMENT	44 TRANSFERS	45 EXP-COLO	46 EXP-WORLD	47 TOTAL
1	FRUIT AG	-0.	-0.	-0.	-0.	2028178.	5701432.	8346927.
2	IRRIG AG	-0.	-0.	2708952.	-0.	3375468.	6514141.	26364707.
3	DRYLAND AG	-0.	-0.	-0.	-0.	202685.	7799188.	8786289.
4	DAIRY AG	-0.	-0.	-0.	-0.	-0.	-0.	5109216.
5	LIVESTOCK	-0.	-0.	-0.	-0.	59115303.	2971668.	80923210.
6	AG SER,FOR	-0.	-0.	67286.	-0.	18437.	12000.	7943210.
7	METAL MIN	-0.	-0.	13704988.	-0.	2314454.	20535808.	41428264.
8	COAL UNDER	-0.	-0.	-0.	-0.	7613837.	29450024.	42381874.
9	COAL STRIP	-0.	-0.	191312.	-0.	14830173.	848826.	21861940.
10	PET-NAT GS	-0.	-0.	692920.	-0.	-0.	170365832.	195677741.
11	NONMET MIN	-0.	-0.	20733.	-0.	-0.	-0.	5845472.
12	CONSTRUCTN	673679.	3623488.	109195054.	1463176.	-0.	-0.	208002112.
13	FOOD PROC	-0.	4927.	246309.	-0.	12488022.	11779242.	35379688.
14	WOOD PROD	-0.	7332.	2423673.	-0.	2666508.	5398437.	13412021.
15	PRINT-PUB	1659.	13953.	-0.	-0.	38876.	885715.	6137173.
16	CONCRETE	194346.	12867.	2748959.	-0.	543124.	91770.	12905873.
17	FAB METALS	-0.	771356.	-0.	-0.	1120586.	2125501.	6798236.
18	ELECTRONIC	-0.	192534.	815228.	-0.	563302.	20504773.	22258839.
19	MFG NEC	49185.	127897.	352971.	-0.	3848563.	12231926.	24385698.
20	TRANSPORT	2191049.	44155.	-0.	-0.	15331489.	5663334.	58910678.
21	POSTAL SER	2343250.	5500.	-0.	-0.	43404.	86820.	7085000.
22	COMMUNICAT	65439.	81358.	-0.	-0.	316129.	936577.	27260416.
23	ELEC-GS UT	247409.	43044.	-0.	-0.	7668987.	9893310.	61842597.
24	WATER-SAN	166694.	37419.	201816.	-0.	-0.	-0.	11338999.
25	WHOLESALE	251969.	62227.	11976160.	-0.	3418396.	6422450.	49919509.
26	GS-AUT DLR	47753.	83891.	6935918.	1104696.	1193267.	1292960.	32227198.
27	EAT-DR-LOD	55694.	7560.	-0.	-0.	19431476.	31243763.	69762358.
28	TRADE NEC	71675.	48092.	2694210.	356220.	4331742.	8481180.	111346618.
29	FINANCE	2874381.	-0.	-0.	-0.	490287.	3925699.	68170580.
30	INS-R EST	12833.	1197792.	9884482.	154012.	1414705.	5907608.	58652916.
31	MEDICAL	3669272.	8053.	-0.	10853557.	1177926.	504825.	65370089.
32	SERVIC NEC	834042.	365536.	181162.	8086510.	15045082.	13186743.	96065912.
33	SUBTOTAL	13745929.	6698981.	165042133.	22018171.	176550406.	384741552.	1491901160.
34	HOUSEHOLDS	10204302.	4585892.	-0.	337879295.	1377396.	-0.	728138444.
35	EDUCATION	2752474.	-0.	-0.	-0.	944815.	546601.	54325477.
36	SOCIAL SER	10812.	-0.	-0.	-0.	-0.	14749.	7622846.
37	LOCAL ROAD	1048484.	-0.	-0.	-0.	7162.	-0.	12717921.
38	LOC GV NEC	2970276.	-0.	-0.	-0.	16955.	38744.	22840055.
39	LOC GV TAX	-0.	78956.	-0.	-0.	1792424.	3027984.	49653170.
40	STATE GV	58342970.	15142.	1809615.	-0.	2643926.	5616086.	127511753.
41	FEDERAL GV	1904576.	66163677.	-0.	-0.	1597391.	3009714.	257896866.
42	PROFITS	16322020.	25075.	-0.	-216017528.	-0.	100683163.	197995425.
43	DEPREC	-0.	-0.	-0.	-0.	-0.	-0.	59834358.
44	TRANSFERS	146897616.	53183.	-0.	-0.	829756.	207439.	283035197.
45	IMP-COLO	1933312.	2101682.	8512316.	63875927.	4992912.	9012247.	268491500.
46	IMP-WORLD	1764093.	4821771.	39350679.	75279332.	13933324.	25211268.	489293433.
47	TOTAL	257896866.	84544359.	214714743.	283035197.	204246067.	532109547.	4071257205.

While these and other items, obtained directly from the transactions table, are useful as initial indicators of the relative importance of each sector in the regional economy, the important question of interdependence is not addressed. In order to do so, it is first necessary to isolate the direct production relationships existing in the economy.

Direct Production Requirements

The direct production requirements, or coefficients, represent the second major component of the interindustry analysis. Computation of the direct production requirements is quite simple, given the transactions table and requires only that each column entry of Table 1 be divided by the respective column total. The resulting coefficients describe the direct purchases necessary from each supplier (at the left of the table) in order for the purchasing sector (at the head of the column) to produce one dollar's worth of output. The coefficients, then, are interpreted as the direct requirements per dollar of output produced by each sector.

These direct impacts identify only a portion of the total economic impacts that would accompany a change in final demands for the output of a given sector. There are additional, or indirect, impacts which can be quite important. Assessment of all direct and indirect impacts of these exogenous (final demand) changes is made possible through the third analytical component of interindustry analysis. This component is the table of direct plus indirect production requirements.

Direct Plus Indirect Impacts

The concept of interdependence can be fairly easily established with a brief example. Suppose that the export demand for coal production increases. There will be immediate, or direct, responses of the following type. Coal production will have to increase. In order for coal production to increase, inputs must be obtained from sectors such as transportation, utilities for power, and labor. These are direct impacts. As transportation and utilities increase their output to meet the increasing requirements in the coal sector, their own requirements for productive ingredients increase, e.g., services, labor, petroleum and natural gas, and coal. The chain of events goes on. The total impacts are readily estimated through the input-output framework.

The direct plus indirect coefficients are interpreted as the production required or generated in all sectors of the economy in order to sustain the delivery of one dollar's worth of output to final demand by any single sector. It should be carefully noted that these coefficients reflect production generated per dollar of final demand as opposed to requirements per dollar of output. This, of course, reflects the fact that the model is driven by changes in final demand.

Business Multipliers

The sums of the direct plus indirect requirements for an industry are termed business activity (or production) multipliers. They identify the total value of production in the region which results from a dollar's worth of output delivered to final demand. Table 2 presents the business multipliers. These estimates indicate that the greatest business activity generated per dollar of delivery to final demand is in the U. S. Postal Service. The business multiplier for this sector is 2.436 which indicates that, as the final demand for Postal Services increases by one dollar a total production of $2.44 is generated in the Northwestern Colorado economy. Other sectors of the economy which have relatively large business multipliers are: construction, 2.319; electricity and natural gas utilities, 2.231; fruit agriculture, 2.159; food processing, 2.135; livestock, 2.118; gasoline service stations and automobile dealers, 2.096, water, sewage, and trash removal services, 2.067; and dairy agriculture, 2.031. These sectors show the greatest degree of interdependence with other sectors of the regional economy. At the margin, these sectors generate the greatest local business activity per dollar of output delivered to final demand. That is, for an equal increase (in dollar terms) in final demands, the Postal Service will generate more business activity in the local economy than will any other sector.

Income Multipliers

Other multiplier effects can also be estimated from the interindustry model. For example, there are income multipliers which relate to changes in income paid to the household sector. The following discussion presents what are termed the Type I and Type II income multipliers.

The Type I and Type II income multipliers are estimated as ratios: Type I is the ratio of direct plus indirect income to the direct income paid households; Type II is the ratio of direct plus indirect plus induced income to direct income. Thus, while the business activity multipliers are related to changes in sales to final demand, the income multipliers are related to changes in income paid to the household sector. The Type I multiplier describes the direct plus indirect income increases emanating from an additional dollar of direct income paid to households. The Type II multiplier takes into account not only the direct plus indirect changes in income, but also the induced income increases generated by additional consumer spending. Accordingly, the Type II income multiplier identifies the direct plus indirect plus induced income generated by an additional dollar of income paid directly to households.

TABLE 2

NORTHWESTERN COLORADO INTERINDUSTRY STUDY BUSINESS ACTIVITY MULTIPLIERS, BY SECTOR, 1974

(in dollars of business activity generated in Northwestern Colorado per dollar delivered to final demand)

Sector	Business Multiplier
1. FRUIT AG	2.159
2. IRRIG AG	1.589
3. DRYLAND AG	1.660
4. DAIRY AG	2.031
5. LIVESTOCK	2.118
6. AG SER, FOR	1.467
7. METAL MIN	1.889
8. COAL UNDER	1.153
9. COAL STRIP	1.604
10. PET-NAT GS	1.341
11. NONMET MIN	1.604
12. CONSTRUCTN	2.319
13. FOOD PROC	2.135
14. WOOD PROD	1.894
15. PRINT-PUB	1.959
16. CONCRETE	1.573
17. FAB METALS	1.869
18. ELECTRONIC	1.766
19. MFG NEC	1.375
20. TRANSPORT	1.614
21. POSTAL SER	2.436
22. COMMUNICAT	1.783
23. ELEC-GS UT	2.231
24. WATER-SAN	2.067
25. WHOLESALE	1.712
26. GS-AUT DLR	2.096
27. EAT-DR-LOD	1.922
28. TRADE NEC	1.907
29. FINANCE	1.351
30. INS-R EST	1.670
31. MEDICAL	1.825
32. SERVIC NEC	1.735

TABLE 3

NORTHWESTERN COLORADO INTERINDUSTRY STUDY
TYPE I AND TYPE II INCOME MULTIPLIERS, BY SECTOR, 1974

(in dollars of income generated in Northwestern Colorado per dollar of direct income paid to households)

	Sector	Income Multipliers	
		Type I	Type II
1.	FRUIT AG	1.834	2.141
2.	IRRIG AG	2.098	2.449
3.	DRYLAND AG	3.423	3.995
4.	DAIRY AG	3.121	3.644
5.	LIVESTOCK	2.501	2.921
6.	AG SER, FOR	1.151	1.344
7.	METAL MIN	1.345	1.570
8.	COAL UNDER	1.302	1.520
9.	COAL STRIP	1.305	1.523
10.	PET-NAT GS	1.718	2.006
11.	NONMET MIN	2.030	2.371
12.	CONSTRUCTN	1.690	1.974
13.	FOOD PROC	1.467	1.713
14.	WOOD PROD	1.368	1.598
15.	PRINT-PUB	1.173	1.370
16.	CONCRETE	1.184	1.383
17.	FAB METALS	1.139	1.329
18.	ELECTRONIC	1.074	1.254
19.	MFG NEC	1.230	1.437
20.	TRANSPORT	1.072	1.251
21.	POSTAL SER	1.016	1.187
22.	COMMUNICAT	1.076	1.257
23.	ELEC-GS UT	1.503	1.755
24.	WATER-SAN	1.336	1.560
25.	WHOLESALE	1.256	1.466
26.	GS-AUT DLR	1.158	1.352
27.	EAT-DR-LOD	1.202	1.403
28.	TRADE NEC	1.202	1.403
29.	FINANCE	1.175	1.372
30.	INS-R EST	1.403	1.638
31.	MEDICAL	1.106	1.291
32.	SERVIC NEC	1.148	1.340

Employment Multiplier Impacts

To assess the total employment impacts of exogenous changes in final demand the respective table of direct and indirect requirements per dollar of delivery to final demand, households exogenous, was pre-multiplied by a diagonal matrix of direct labor use requirements. Summing down the respective columns of the resulting matrix yielded the estimates of the direct and indirect labor requirements per dollar delivered to final demand. Table 4 presents the estimates.

The interpretation of the entries in Table 4 is demonstrated by an example from the surface coal mining sector. As the final demand for the output of the surface mining of coal expands by $1, there will be a direct expansion of employment in that sector as well as those sectors responsible for supplying production ingredients to the surface mining of coal sector. The sectors supplying ingredients to the surface mining of coal sector will in turn require production ingredients from others and this will further expand indirect employment impacts. Thus the magnitude of the direct and indirect employment impacts, $.000014, shows the total employment generated in the entire Northwestern Colorado economy as this single sector, surface mining of coal, increases its deliveries to final demand by one dollar. That is to say that an increase of $1 million dollars in the final demands, e.g., exports to the Front Range or out of state, for surface mined coal would result in an estimated additional employment of 14 persons in Northwestern Colorado. All remaining entries in Table 4 have analogous interpretations for their respective sectors. Thus, the leading sectors in terms of direct and indirect employment generation in the Northwestern Colorado economy are eating and drinking establishments and lodging facilities, dairy agriculture, livestock production, electronics, fruit agriculture, gasoline service stations and automobile dealers, and health and medical care facilities.

Water Use Analysis

The water use analysis requires data pertaining to water withdrawals and consumptive use on a sector by sector basis. It is further required that these data be related to economic activity on a per dollar sales basis.

The model allows the analysis of direct and indirect water use which parallels the previous discussion of direct and indirect production. The purpose of such analysis is to isolate the effect of economic interdependence on water requirements. The specific question to be addressed is that of determining the likely impact of expanding final demand in any or all processing sectors on the regional water requirements. The key element in the assessment is the derivation of the direct plus indirect water requirements per dollar of output delivered to final demand. The direct withdrawal and consumptive use requirements estimated for sectors of the regional economy are shown in Table 5. Direct plus indirect requirements are presented in Table 6. The importance of considering indirect as well as direct water requirements in the planning perspective can be readily seen by comparing Table 5 and Table 6. Consider, for example, the direct withdrawal and consumptive use requirements for livestock and dairy in Table 5. These direct requirements are rather small, respectively 30 and 16 gallons for each dollar of output. However, as the final demand for the output of the livestock sector expands by one dollar there is a total direct plus indirect water requirement of 2,802 gallons (withdrawal) and 1,128 gallons (consumptive) generated throughout the economy. Similarly, in the dairy sector a one dollar increase in the final demand for dairy products generates a total direct plus indirect water requirement of 11,059 gallons (withdrawal) and 4,378 gallons (consumptive) throughout the economy. The indirect impacts,

TABLE 4

NORTHWESTERN COLORADO INTERINDUSTRY STUDY DIRECT PLUS INDIRECT LABOR REQUIREMENTS PER DOLLAR DELIVERED TO FINAL DEMAND, BY SECTOR, 1974

(in workers per dollar)

Sector	Direct Plus Indirect Labor Requirement Per Dollar of Final Demand
1. FRUIT AG	.000061
2. IRRIG AG	.000051
3. DRYLAND AG	.000053
4. DAIRY AG	.000069
5. LIVESTOCK	.000068
6. AG SER, FOR	.000041
7. METAL MIN	.000028
8.. COAL UNDER	.000026
9. COAL STRIP	.000014
10. PET-NAT GS	.000007
11. NONMET MIN	.000015
12. CONSTRUCTN	.000034
13. FOOD PROC	.000050
14. WOOD PROD	.000042
15. PRINT-PUB	.000057
16. CONCRETE	.000027
17. FAB METALS	.000039
18. ELECTRONIC	.000065
19. MFG NEC	.000018
20. TRANSPORT	.000024
21. POSTAL SER	.000053
22. COMMUNICAT	.000037
23. ELEC-GS UT	.000025
24. WATER-SAN	.000042
25. WHOLESALE	.000032
26. GS-AUT DLR	.000063
27. EAT-DR-LOD	.000097
28. TRADE NEC	.000059
29. FINANCE	.000018
30. INS-R EST	.000031
31. MEDICAL	.000060
32. SERVIC NEC	.000044

TABLE 5

ESTIMATED WITHDRAWAL AND CONSUMPTIVE USE REQUIREMENTS BY SECTOR, NORTHWESTERN COLORADO, 1974

(in gallons per dollar of output)

Sector	Withdrawal	Consumptive Use
1. FRUIT AG	2,409.0	383.0
2. IRRIG AG	2,479.0	9,798.0
3. DRYLAND AG	0.0	0.0
4. DAIRY AG	16.0	16.0
5. LIVESTOCK	30.0	30.0
6. AG SER, FOR	8.0	.8
7. METAL MIN	108.0	32.4
8. COAL UNDER	1.0	0.0
9. COAL STRIP	11.0	1.1
10. PET-NAT GS	27.0	6.2
11. NONMET MIN	137.0	4.8
12. CONSTRUCTN	4.0	.4
13. FOOD PROC	6.0	.4
14. WOOD PROD	27.0	6.2
15. PRINT-PUB	2.0	.2
16. CONCRETE	52.0	13.0
17. FAB METALS	7.0	1.7
18. ELECTRONIC	2.0	.4
19. MFG NEC	20.0	2.6
20. TRANSPORT	2.0	.1
21. POSTAL SER	1.0	.1
22. COMMUNICAT	2.3	.2
23. ELEC-GS UT	267.0	13.4
24. WATER-SAN	0.0	0.0
25. WHOLESALE	2.3	.2

TABLE 6

DIRECT PLUS INDIRECT WATER REQUIREMENTS NORTHWESTERN COLORADO, 1974

(in gallons per dollar of output delivered to final demand)

Sector	Withdrawal	Consumptive Use
1. FRUIT AG	2,459.91	400.61
2. IRRIG AG	24,824.70	9,810.02
3. DRYLAND AG	54.08	19.46
4. DAIRY AG	11,059.15	4,377.96
5. LIVESTOCK	2,802.53	1,127.69
6. AG SER, FOR	145.34	53.59
7. METAL MIN	134.24	37.79
8. COAL UNDER	7.06	.39
9. COAL STRIP	22.85	1.82
10. PET-NAT GS	39.16	7.26
11. NONMET MIN	145.45	5.36
12. CONSTRUCTN	15.34	1.71
13. FOOD PROC	5,000.82	1,969.67
14. WOOD PROD	54.72	13.58
15. PRINT-PUB	6.45	.49
16. CONCRETE	60.26	13.40
17. FAB METALS	11.86	2.02
18. ELECTRONIC	4.53	.55
19. MFG NEC	28.29	3.07
20. TRANSPORT	2.97	.18
21. POSTAL SER	3.49	.25
22. COMMUNICAT	4.37	.33
23. ELEC-GS UT	344.17	18.40
24. WATER-SAN	9.08	.54
25. WHOLESALE	5.99	.44
26. GS-AUT DLR	7.17	.49
27. EAT-DR-LOD	17.44	2.70
28. TRADE NEC	10.06	.76
29. FINANCE	4.22	.32
30. INS-R EST	12.36	1.13
31. MEDICAL	17.66	4.62
32. SERVIC NEC	12.13	.95

because of the significant interdependencies between these sectors and irrigated agriculture, are far more important than the direct requirements. Applying only the direct water requirements to assumed increases in deliveries to final demand can obviously result in an understatement of water use.

Coal Growth Scenarios

The second extension of the basic model employs two alternative sets of estimated growth in final demands for surface and underground coal mining. The purpose of this analysis is to assess the impacts of growth in these two sectors on regional output, income, employment and water use. The analysis demonstrates very clearly the use of the input-output model as a tool for consistent forecasting.

The projected deliveries by the two coal sectors to export markets within Colorado (but outside the region) and to markets outside the state are shown in Table 7. There are two sets of estimates, which represent conservative and speculative projections, for each sector. Table 8 identifies the impacts of these growth scenarios on the economic variables: output, employment, income, and water use.

The estimates presented in Table 8 are to be interpreted in the following manner. First, consider the total output change under the scenario for underground coal. As the final demand expands to the level projected for 1980 a series of production impacts is generated throughout the economy. This occurs because of the interdependence existing between the underground coal sectors and other sectors of the economy. As these impacts work themselves out the total additional value of production of $153.12 million is generated. This is not the additional value of underground coal production but the additional value of production generated in all sectors of the economy in order to satisfy

TABLE 7

PROJECTED VALUE OF UNDERGROUND AND SURFACE COAL DELIVERIES TO EXPORT MARKETS, NORTHWEST COLORADO ECONOMY

(in dollars)*

Underground Coal

	Conservative		Speculative	
Year	Colorado	Out-of-state	Colorado	Out-of-state
1980	14,544,000	138,345,760	16,160,000	138,345,760
1985	14,544,000	148,849,760	16,160,000	148,849,760
1990	17,776,000	150,465,760	17,776,000	247,425,760

Surface Coal

	Conservative		Speculative	
Year	Colorado	Out-of-state	Colorado	Out-of-state
1980	31,108,000	23,433,768	31,108,000	46,842,250
1985	31,385,750	29,266,518	31,385,750	46,939,750
1990	27,219,500	29,266,518	27,219,500	46,939,750

SOURCE: BLM, USDI, Draft Northwest Colorado Coal EIS, June 1976. BLM in house reports.

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* Underground coal is priced at $16.16 per ton. Surface coal is priced at $5.56 per ton.

TABLE 8

ESTIMATED CHANGES IN SELECTED VARIABLES 1974-1980, 1974-1985, 1974-1990 ASSOCIATED WITH PROJECTED COAL SECTOR DELIVERIES TO EXPORT MARKETS[1]

Underground Coal

	Conservative			Speculative		
	1974-1980	1974-1985	1974-1990	1974-1980	1974-1985	1974-1990
Total Output Change[2]	153,121,839	167,008,127	173,417,183	155,258,191	169,144,479	301,598,303
Total Income Change I[3]	47,078,875	51,182,298	53,073,970	47,717,296	51,818,902	90,939,446
Total Income Change II[3]	54,961,573	59,751,992	61,960,395	55,706,828	60,495,185	106,165,867
Total Employment Change[4]	3,011	3,285	3,411	3,053	3,327	5,932
Total Water Use Change[5]	140	151	157	141	153	273

Surface Coal

	Conservative			Speculative		
	1974-1980	1974-1985	1974-1990	1974-1980	1974-1985	1974-1990
Total Output Change[2]	48,189,844	55,766,854	50,600,704	77,216,351	77,681,661	72,515,511
Total Income Change I[3]	13,837,738	15,225,085	14,284,161	19,136,414	19,225,713	18,324,430
Total Income Change II[3]	16,149,330	17,768,433	16,670,327	22,333,149	22,437,364	21,385,523
Total Employment Change[4]	544	630	571	872	877	819
Total Water Use Change[5]	217	251	228	348	350	327

1. These changes are changes throughout the entire economy resulting from changes in deliveries to final demand (exports) by the two coal sectors.

2. These are dollar values.

3. These are changes in dollar value of payments to households. Change I reflects direct and indirect income change. Change II reflects direct, indirect, and induced income change.

4. Units are numbers of workers.

5. Units are acre-feet of water consumed.

the increased final demand for underground coal. As the 1985 final demand projection is realized, there is an additional $162.01 million worth of output generated in the economy over the 1974 levels. Thus, there is a change of $13.89 million worth of output between the 1980 and 1985 levels. The remaining economic variables of Table 8 are interpreted in the same manner.

It will be noted that there are two estimates of changes in household income payments presented in Table 8. The income change I is the direct plus indirect income change generated by changing final demands. Income change II includes also the induced impacts of increased household spending.

A third scenario was also included in the analysis of altering the deliveries of coal to final demand. It is known that electric power generation (included in sector 23) is a large coal consumer and is also expected to expand quite rapidly over the period 1974-1980. There are estimates of the expected coal requirements by electric power generation to the year 1980 and from these, it is possible to calculate the projected increase in final demand for electric power output. The projected change in electric power final demand between 1974 and 1980 is $263.74 million dollars. The estimated impact of this final demand increase translates into an additional output, over 1974 levels, valued at $443.35 million; a type I income change of $108.63 million; a type II income change of $126.84 million; additional employment of 6,594 workers; and increased consumptive use of water amounting to 10,846 acre-feet. Since the projected purchase of coal by the electric power sector consists solely of purchases of strip mined coal, these estimates should be added to the 1980 conservative and speculative estimates for surface coal in order to assess the total impacts of the combined increases in coal deliveries to final demand and electric power deliveries to final demand. This combined impact could result in a conservative and speculative set of changes as shown in Table 9.

TABLE 9

ESTIMATED CHANGES IN SELECTED VARIABLES 1974-1980 ASSOCIATED WITH PROJECTED COAL AND ELECTRIC POWER SECTOR DELIVERIES TO FINAL DEMAND[1]

	Conservative	Speculative
Total Output Change[2]	$644,661,683	$675,824,542
Total Income Change I[3]	169,546,613	175,483 710
Total Income Change II[3]	197,950,843	204,879,977
Total Employment Change[4]	10,149	10,519
Total Water Use Change[5]	11,203	11,335

1. These changes are changes throughout the entire economy resulting from changes in deliveries to final demand (exports) by the two coal sectors.
2. These are dollar values.
3. These are changes in dollar value of payments to households. Change I reflects direct and indirect income change. Change II reflects direct, indirect, and induced income change.
4. Units are numbers of workers.
5. Units are acre-feet of water consumed.

The estimates presented in tables 7-9 are not meant to be predictions of what the future will hold for the Northwestern Colorado Economy. However, they are based upon fairly reasonable estimates of expanded coal and electric power deliveries to final demand. Alternative growth scenarios can be accommodated relatively quickly and inexpensively. The analytical capability has been developed and is available for further use.

The estimates presented in tables 7-9 are not meant to be predictions of what the future will hold for the Northwestern Colorado Economy. However, they are based upon fairly reasonable estimates of expansions of coal and electric power deliveries to final demand. Alternative growth scenarios can be accommodated relatively quickly and inexpensively. The analytical capability has been developed and is available for further use.

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